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GEOLOGICAL REPORT ON SAYER'S LEASE MOINA

SUMMARY

The economic future of Sayer's Block is not bright. A good quantity of wolfram occurs but in thin irregular veins,,whereas the beryl exposed so far would only constitute a by-product.

The previous "line of lode" idea of the deposit should be abandoned in favour of a concept whereby the zone of mineralization is regarded as an area of granite in which the numerous parallel cross joints have been mineralised with stringers of quartz carrying wolfram. Geophysical methods are not applicable nor warranted on this type of deposit.

Profitable extraction of the minerals from the small veins and stringers will only be possible on a limited scale in favourable places.

INTRODUCTION

The 80 acres formerly known as Sayer's block has now been marked out for Norman C. Paul by R.H.W. Molesworth.

Mr. Molesworth has requested a geological and geophysical examination and information regarding the treatment of beryl ore. As a result of this request the Director of Mines has ordered this geological examination to determine future procedure.

The lease is well down in the Forth Valley to the east of Moina and a short distance south of Narrawa Creek. A jeep track from the Middlesex main road is open to within about 1,000 feet of the western boundary. An extension to this track which was originally to serve the Squib Mine is now projected. It is to be formed by bulldozer down the steep slope to the main workings on Sayer's block.

The workings which are exploratory trenches and shafts have been extended very little since they were examined by Twelvetrees in 1913. Reports subsequent

to Twelvetrees whose report was fairly comprehensive have given little additional information concerning this deposit.

Since no aerial photographs of this area are available mapping was done by chain and compass with abney readings to correct for slope. The area covered by this method encompasses the 80 acres of the former Sayer's lease. Some of the original survey markings are still visible and the chain and compass traverses were tied in with these.

GENERAL GEOLOGY

The igneous rock responsible for the mineralisation is a Devonian granite. It is a pink granite composed of the usual biotite, felspar and quartz with greisen and aplitic phases. On both sides of the Forth River and probably over most of the granite area the outcrops are traversed by numerous thin quartz veins most of which contain small amounts of wolfram and some tin.

Tourmaline has not been observed in the granite but volatiles such as topaz and fluorite are common. The finer grained aplitic phases are found in several places along the northern section of the lease. The rock is mainly quartz and felspar of uniform grain size with white mica and fluorite. In general the Dolcoath granite has a variable composition. There are no really large masses of the rock which are uniform. Quartz veins, greisen formations, aplitic or coarse phases occur throughout the mass.

The irregular contact between the granite and sediments is mapped along the northern boundary of the lease. The granite has its finer grained phases near the margin while the sediments in places show incipient recrystallisation mainly of quartz. A tough dense ferruginous rock which is probably a hornfels occurs in the northwest area of the lease. It is described by Twelvetrees as a greenish "pyroxene" contact rock. On the actual contact quartz veins tuff and micaceous greisen occur.

The sediments near the contact are highly

altered. Iron rich hornfels probably represents the contact metamorphic equivalent of the quartzites while the softer beds are represented by contorted highly ferruginous zones. Several such iron rich beds are exposed in No. 2 Adit.

It is probable that the granitic area is anticlinal. The arching of the mass of recrystallised rock and sediments has put the perimeteral zone in tension resulting in a cross joint fan or a series of almost parallel "Q-joints" which have been subsequently mineralised with quartz and wolfram.

ECONOMIC GEOLOGY

Several lodes on the property are developed. The main workings are a series of trenches and shallow shafts cut across what Twelvetrees describes as the "main line of lode". There is no single continuous lode. The trenches actually expose a series of approximately parallel veins which follow the main fracture pattern of the granite. These south dipping fractures persist into the sediments in the northwest section of the block where they are normal to the north dipping bedding. Both in the sediments and granite quartz veins or lodes occur on the fractures. Usually the veins carry a little wolfram.

Compared to information available when the workings were first opened current observations are somewhat limited. Most of the trenches and shafts are partly filled and overgrown. Often lodes previously exposed could not be relocated in the workings. Therefore, although it is not usual to incorporate previous work to this extent, the observations of Twelvetrees taken 40 years ago in 1913 when the workings were more recently opened, are tabulated for comparison with current observations. The table then gives for reference all the detail of individual workings. The individual descriptions of lodes, country rock, mineralisation and values where assays were done, are listed.

4. Comparison of Workings as observed by Twelvetrees - 1913 - with current observations

WORKINGS	1913	CURRENT	REMARKS
Main Shaft	Depth 36 ft. Water level 20 ft. Sunk on underlay on greisenised pegmatitic blow.	12 ft. deep filled with rubble	Shaft partly filled
	Surface formation 3 ft. wide. 4 ft. wide at water level	Micaceous coarse crystalline formation with large quartz crystals also felspar, mica, beryl.	
	3 ft. greisen plus 2 ft. mineralised granite at the bottom of shaft. Dip of lode is rather flat to 190°.	27 inches wide 3 ft. below surface.	Width normal to lode plane
	Rich ore for several feet.	Bottom of shaft not accessible.	
	Lean values to 28 ft. 28 to 35 ft. mineral makes again	Lode dips 62° to 193°. Irregular dip plane.	
		Sample 3 ft. below surface assays WO_3 ... Nil Sn^3 ... Possible Trace Bi ... Under 0.1	Oxidised material non representative sample.
		Not accessible	
No. 1 Adit	Driven 50 ft. including approach. Small quartz vein in approach 2 to 3 inches wide carries coarse wolfram	Direction of crosscut 202° 25 ft. from portal to face. A 2 inch quartz vein in the approach carries wolfram and dips 50° to 187°.	The aplitic granite forming the country rock contains large phenocrysts of quartz and pink felspar sparsely set in a fine grained white matrix. Little ferromagnesian mineral but possibly hematite.
	A few feet in the adit a 2 ft. quartz formation apparently barren dips 15° to 180°	Hard siliceous pyritic bands near the vein dip in conformity. Fine grained and kaolinised porphyritic phases alternate with the hard siliceous pyritic "lodes"	

WORKING	1913	CURRENT	REMARKS
No. 1 Trench	Hard siliceous formation a little over 2 ft. wide with wolfram scattered through it. No tin.	Pit is 10 ft. deep in medium to coarse weathered granite. It exposes a siliceous greisen with quartz veins in the formation. The formation is 17 inches wide dipping 51° to 208° and it contains pyrite, mica and crystalline quartz with a little wolfram.	An 85 ft. trench with a pit near its southern end.
	3 veins in the trench on the north side spread over 6 or 7 ft. and contain wolfram.	Northern part of the trench is partly filled and no veins are visible	A sample taken across the lode assays WO_3 ... 0.1 Sn ... Trace Bi ... 0.1 but it is not representative
No. 2 Trench	Formation 3 ft. wide. 1 ft. carries wolfram associated with coarse quartz. No tin visible. Siliceous reddish purple lodestuff.	Trench partly filled. No outcrop of vein. Boulders on dump contain vein material to 3" wide of crystalline quartz with blade wolfram and cassiterite Apparently good wolfram in very narrow vein or veins.	Trench 27 ft. long in medium to coarse granite. Vein would not be expected to be the same as that in the main shaft as southerly dip would throw outcrop southwards on descending.
No. 3 Trench	Between the shaft and the northern boundary on a parallel lode. A quartz lode in altered granite country with green and purple fluorspar, pyrite and a little wolfram. A 2 inch quartz vein carrying wolfram parallel and 3 ft. from a 3 ft. formation with specks of molybdenite.	A silicified pyritic greisen formation in medium grained granite which has coarse quartz crystals and weathered greeny felspar. Lode dips 60° to 205° with a width greater than 3½ ft. but obscured. It contains a little wolfram in odd specks and pyrite in blebs and grains with quartz and mica.	Very hard vein rock.

WORKING	1913	CURRENT	REMARKS
No. 4 Trench	Trench 40 ft. long on the main lode. It contains cassiterite scattered in altered granitic rock	Hard siliceous pyritic material in a medium grained weathered granite. On the dump is remnants of a quartz vein greater than 2 inches wide and greisen. These contain wolfram and cassiterite.	Trench partly filled.
No. 5 Trench		Main lode exposed in the end of trench shows a hard siliceous hanging wall over 16 inches of greisen with bands of kaolinitic porphyry and hard pyritic siliceous material. Lode dips 49° to 177° and contains crystalline quartz in vughs and veins with mica and beryl.	Driven 100 ft. southwards to test for parallel formations. None met with. No tin or wolfram visible.
Nos. 6 & 7 Trenches	Quartz veins and vugh of quartz with wolfram in radiating blades. Formation 3 ft. wide.	Trenches partly filled with rubble.	In soft micaceous weathered granite.
No. 8 Trench	Soft micaceous granitic rock. Vein of beryl with pale bluish green crystals 3" to 4" long and 1/6 to 1/4 inch in diameter.	A vein of beryl containing wolfram occurs in soft micaceous granite but footwall of vein is hard silicified material for about 1 ft.	Beryl Trench. Enlarged to about 20 ft. deep with an underlay shaft and cuddies both ways.

WORKING	1913	CURRENT	REMARKS
No. 8 Trench (cont.)	Pegmatitic lode in aplitic and greisenous granite.	**East Cuddy** Main vein strikes 276° dips 44° S Sample assaying - WO_3 ... Nil Sn ... Under 0.1 Bi ... 2.2 from puggy micaceous vein material.	Not a representative sample.
		West Cuddy 2 inches Beryl on hanging wall and 10 inches hard siliceous greisen on footwall. Sample near the bottom of shaft assays - Wo_3 ... 1.6 Sn ... Trace Bi ... 0.1	Wolfram and mica in the beryl vein. Narrow beryl vein would not appear to be economic for beryl. Sample non representative.
		Sample about 6 ft. higher up the vein Wo_3 ... Nil Sn ... 0.64 Bi ... 5.0	Wolfram visible in vein.
No. 9 Trench	Quartz vein with beryl contains fair quantity of wolfram. Formation in two bands 2 ft. and 1½ ft. with 4 ft. granite between	In medium grained granite a 16" formation dips 46° to 194° strike 284°. There are hard siliceous and softer greisenous phases. The mineralisation is crystalline, quartz, mica, pyrite and a little wolfram.	

WORKING	1913	CURRENT	REMARKS
No. 10 Trench	Cuts the lode capping. 2 ft. of greenish yellow quartz-mica rock traversed by bands of harder ferruginous and siliceous stone. No wolfram visible.	In medium grained granite with a little pyrite is 2 inches of hard siliceous formation with greisenous pockets on the foot wall.	The lode is mainly obscured since the trench is partly filled.
No. 11 Trench	No lode in soft light-coloured greisenised rock.	Trench partly filled. Soft greisenous micaceous country rock from dump.	
No. 12 Trench	6 inch vein and 2½ inch vein with 4 inches of soft greisen between. Dips S at 55° to 60°. Lodestuff contains a little wolfram.	Country rock altered granite. Three quartz veins one 2 inches wide dipping 60° to 173° and 2 lower 1 inch veins 4 inches apart dipping in conformity.	Pit 25 ft. x 10ft. x 8 ft. deep. Purpose of the great pit is not clear. Water level 3 ft. below present ground surface.
No. 13 Trench	15 ft. deep. Similar to Trench 12.	3 small stringers of quartz in granite are approximately 6 inches apart dipping 45° to 187°. Width of stringers is ½ to 1 inch but they appear barren. Sample of upper vein 1" thick gives - WO_3 ... Nil Sn ... Nil Bi ... Nil Sample of middle vein which averages ¾" gives - WO_3 ... 0.1 Sn ... Nil Bi ... Trace	Depth of water level 10 ft. below surface. Samples are not representative of vein content since they are too local.

WORKING	1913	CURRENT	REMARKS
No. A Trench	Probably not dug. No description.	A trench 24 ft. x 3 ft. and 6ft. deep in weathered granite of medium grain with greenish mica. Quartz crystals predominating. The felspars are kaolinised	No lode could be found.
No.14 Trench	Still in overburden	Country rock is fine grained grey quartzite thinly bedded with "lit par lit" structure. Overburden is not penetrated.	Quartz stringers carrying Wolfram on the dump.
No. B Trench	No description	Small trench 6ft. x 2ft. which is shallow and does not penetrate overburden.	
No. 15 Trench	4ft. red soil and 7ft. of iron manganese overburden which is not bottomed. A quartz vein 5 to 6 inches wide with southerly dip carries a little wolfram.	Pit 6ft. x 6ft. and 8ft. deep. Country rock is dark almost black to grey ferro-manganese quartzite. Strike 125° dip 60° to 035°. Fracture dips 60° to 205°. Lode not visible in trench but boulders with 1" quartz vein carrying wolfram on the dump appear to have come from the pit.	
No. C Trench	No description.	Pit 6 ft. x 4ft. at present 4½ ft. deep in dark iron rich quartzite. The lode is not visible but the country is dipping 60° to 022°.	

WORKING	1913	CURRENT	REMARKS
No. D Trench	No description	Trench 30ft. x 2ft. through dark iron rich quartzite. The dip appears shallow to the north 25°. No lode found in trench but boulders on the dump contain quartz veins with wolfram to 2" wide.	
No. 16 Trench	Cuts a 6 inch vein of clean quartz containing a little coarse wolfram	Almost black fine grained quartzite rich in iron is cut by pit 5 ft. x 5 ft. and 7 ft. deep which grades out on the southern end to a shallow trench in overburden. Country dips 42° to 008° and has shales interbedded. Dominant fracture direction is vertical striking 352° and a secondary fracture direction dips 50° to 170°. Boulders of quartz with wolfram are found on the dump but no lode is visible.	
No. 2 Adit	Iron manganese formation for 40ft. dips north at a low angle. The adit then passes into hornfels. A small quartz vein contains fluorite mica and specular hematite.	At the face a hard dark blue grey quartzite dips 53° to 030°. 30ft. in a soft ferruginous pug which may have been a former shale bed dips 46° to 040°. The cleavage which is mineralised by tiny quartz stringers dips 45° to 178°.	Adit is 60ft. long being driven approximately 178° in a whole series of highly ferruginous quartzites and softer beds The compass is affected by the high iron content.

WORKING	1913	CURRENT	REMARKS
Poveys Lode	Developed after Twelvetrees 1913 report and noted by McIntosh Reid 1919. Country rock is tubicolar sandstone. Lode developed by crosscut 25 ft. long sent in at 205° and the lode driven 8 ft. west and 55 ft. east. The quartz lode is 3 to 8 inches wide carrying a fair percentage of wolfram and a little molybdenite. Thin veinlets of black earthy manganese oxide occur in the bedding-planes of the quartzite near the lode.	Hard blue grey ferruginous quartzite dips 40° to 025° and a quartz vein up to about 6 inches wide with knots of quartz to about 1 ft. is injected on the cleavage dipping 50° to 205°. There seems to be good wolfram in patches with a little molybdenite mica and crystalline quartz. Crosscut is 25 ft. long and driving 30 ft. west and 85 ft. east with stoping to the surface through the shallow backs along the length of the drive (115°)	Not on Sayer's Block. Veins north of Narrawa Creek and outcropping at the waterfall would perhaps be comparable. Compass is affected by iron content of the rocks.
Blacks Lower Shaft No.2 S.E.	Underlay shaft sunk 35 ft. and a chamber at 20 ft. Sunk on a dark green micaceous greisen with micaceous iron ore. Quartz veinstuff and wolfram picked up on the tip. Lode bears north-westerly.	Surface quartzite is ferruginous and heavily ferruginous "shales" contain pockets of mica. The dump shows pyritic siliceous porphyry, very ferruginous quartzite with quartz stringers containing a little wolfram and porphyry with pockets of greisen and kaolinitic material.	Shaft inaccessible and filled to about 20 ft.

WORKINGS	1913	CURRENT	REMARKS
Blacks Lower Shaft No. 3 N.W.	Vertical shaft sunk 40 ft. with a drive south. Greisenised granite country rock at the surface but enters sandstone since pyroxene contact rock and sandstone are found on the dump. Quartz veins in the granitic rock contain a little molybdenite.	Shaft is filled to about 25 ft. The dump is mainly felspathic and porphyritic granite with less ferruginous greisen but this material apparently came from the bottom of the shaft. No quartz or wolfram observed.	Shaft inaccessible.
Blacks Upper Shaft No. 1	The shaft on a southerly underlay is 30 to 35 ft. deep. Vein width is 6 inches to 1 ft. and in the prospecting cuddies driven both ways at the bottom of the shaft it is 7 or 8 inches wide with crystalline quartz, pyrite and chalcopyrite. Quartz combs carry clean wolfram the best values being near the surface.	A stronger quartz vein 6 inches in width and carrying clean wolfram dips 45° to 216° in weathered granite. Shaft is 25 ft. deep on the underlay with the water level at 21 ft. and the vein is gouged out both ways at the bottom.	One of the most likely veins.

WORKING	1913	CURRENT	REMARKS
Blacks Upper Shaft No. 1 (cont.)		Sample from S.E. side of the shaft at the bottom gives - WO_3 ... 0.74; Sn ... Possible Trace; Bi ... 0.15. Sample from N.W. Side gives - WO_3 ... 0.5; Sn ... 0.1; Bi ... 0.2	Samples not representative
Blacks Lode Trench 1.	The vein consists of comby wolfram bearing quartz 1 ft. wide with an associated formation 2 ft. wide the vein being in the centre.	Partly filled trench in granite with boulders of hard siliceous felspar poor material on the dump. Veins of quartz carrying wolfram up to 1 inch wide also on the dump.	
Blacks Lode Trench 2.	Formation 18 inches wide with somewhat less wolfram in the vein.	Altered granite country rock. Near the dump are boulders of hard siliceous material with large crystals of quartz and green mica phenocrysts set in a fine grained groundmass of quartz. Felspar absent or very poor. Lode not visible.	

WORKING	1913	CURRENT	REMARKS
Blacks Lode Trench 3.	A 2 ft. formation carrying a vein 4 to 6 inches wide. The lode contains a little wolfram but looks unpromising. Soft felspathic granite country.	Completely obscured.	
Blacks Lode Trench 4	2 ft. of greisen formation with 4 inches of veinstone charged with a little wolfram and pyrite. Nothing payable.	Country rock in situ is obscured but boulders which appear to have come from the trench are of compact greenish grey aplite. Lode is not visible.	
Blacks Lode Trench 5.	No description	Not recorded.	
Blacks Lode Trench 6.	No description.	Trench approximately 30 ft. long with south end deepened to follow a 1 inch lode of fine grained aplitic material. South side of vein country is a soft white weathered felspathic rock. Harder reddish rock on north side shows phenocrysts of quartz and the same ferro-magnesian mineral. Vein appears barren but wolfram in quartz veins on the dump.	

WORKING	1913	CURRENT	REMARKS
Blacks Lode Trench 7.	No description.	Very siliceous hard granitic country rock with green mica and lacking felspar is observed on the dump. No country rock visible in trench.	
Blacks Lode Trench 8.	No description.	In granite is a hard siliceous fine grained greenish grey 2 inch vein which dips 55° to 185°. A concordant quartz vein immediately below is 6 inches wide and carries bladed wolfram which seems to be confined to a zone about 1 inch wide. A sample of the quartz vein gives - WO_3 ... 1.7 Sn ... Trace Bi ... 0.3	Not the same vein as in Blacks Upper Shaft Not a representative sample
Unnamed Shaft	No description.	A shaft about 20 ft. deep with short crosscuts both ways. The hard grey siliceous formation on which the shaft was sunk dips 60° to 205°. It is 1 ft. wide with a smaller 2 inch formation beneath. Altered felspathic greenish ferro-magnesian poor granite country rock. No wolfram.	Shallow shaft and cross-cut about the centre and slightly south of the main lode line.

WORKING	1913	CURRENT	REMARKS
<u>Southern Wolfram Lode</u> <u>Adit</u>	Adit driven for about 30 ft. on irregular quartz mica separated by silicified and greisenised rock. Strike 305° dips S.W. Blade wolfram molybdenite and pyrite with sometimes bismuthinite fluorite and chalcopyrite. Vein can be traced eastwards over Castle Creek. Richest section of the vein is about half way in this drive.	Country rock has a fine matrix with very large quartz and felspar phenocrysts. The irregular vein about 3 to 4 inches wide dips 47° to 213° being comby quartz with vughs and blade wolfram and pyrite. The direction of the drive is 303°. The vein at the face is 6 inches and a sample assays - WO_3 ... Nil Sn ... Nil Bi ... 0.16 while the hanging wall rock at this point gives - WO_3 ... Nil Sn ... Possible Trace Bi ... Under 0.1 A sample from the backs about half way in gives - WO_3 ... Nil Sn ... Nil Bi ... Under 0.1	The vein narrows to 1½" in the granite face about 50 ft. below the adit. It contains mica, some wolfram and is very pyritic. It could not be traced for further than about 60 ft. Sample fairly representative of the vein material at this point. Not a representative sample.

WORKING	1913	CURRENT	REMARKS
Southern Wolfram Lode No. 1 Trench	Stone with large pieces of wolfram.	Some vein material with wolfram on the dump apparently extracted from the trench but the country rock in the trench is obscured.	Above the drive.
Southern Wolfram Lode No. 2 Trench	The trench is 20 ft. above the drive and the lode capping has been stripped for 25 ft. The lode shows greisen vein matter with poorer wolfram.	No lode visible but vein material with a little wolfram on the dump.	Trench almost filled.
Southern Wolfram Lode. No. 3 Trench	A little coarse wolfram in hard vein quartz and quartz rock associated with fluor and mica. The quartz is very stained with iron oxide.	The dump beside the 25 ft. trench which is cut to 300° shows a hard pyritic siliceous lode with vein quartz containing a little wolfram to 6 inches wide. Micaceous greisen also occurs but the mineralisation of the vein material on the dump is comparatively light.	Trench partly filled.
Southern Wolfram Lode No. 4 Trench	The overburden has been stripped and stones on the surface of the lode consist of vein quartz and pink quartz greisen containing some coarse wolfram and a little bismuth carbonate.	The vein in weathered granite is obscured but the dump shows a width greater than 3 inches with comby quartz containing a little wolfram.	Trench partly filled.

WOLFRAM

Earlier reports to some extent infer a wolfram content for lode matter and formations of considerable thickness. It is true that almost every quartz vein contains some wolfram, but the veins are thin. The formations and lode matter referred to are variants of the granite which are greisenous, aplitic, siliceous or felspathic zones concordant with the quartz stringers which carry the mineralisation. The country rock and "lodes" carry the economic minerals only to the extent of occasional specks but the "lodes" or formations often contain two or three quartz veins. Veins to 6 inches and greater in width are found but they are commonly 2 inches and less.

Considerable work has been done developing and testing barren "lodes" such as that exposed in the unnamed shaft. These lodes are aplitic variants of the granite. They are zones of varying thickness which are highly siliceous and sometimes pyritic but carry at most only occasional specks of economic minerals. However they are parallel to the general fracture pattern of the granite and are often associated with the quartz veins which are mineral bearing.

The absolute unreliability of the sampling which has already been done should be emphasised. The samples were taken in an effort to gain some general impression of the values to be expected. It is hoped that the more favourable results will lead to further sampling on those particular lodes. To give a better conception of the actual working values parcels of ore large enough to be representative of the vein material should be extracted and quartered down for assay. The erratic distribution of the wolfram bunches will make even these larger samples somewhat unreliable but their assays would indicate the basis on which the work should be carried forward.

As it stands the lode exposed in Blacks Upper Shaft and the vein in Blacks Upper Lode Trench 8 have given the best results.

In the shaft the 6 inch vein contains

clean bladed Wolfram and assays of the vein material show 0.74 and 0.5% WO_3. The bismuth content of this lode given by assay as 0.15 and 0.2 is above the limit of 0.05 tolerated in wolfram concentrates. Therefore, it would have to be removed in the ore dressing. The price of wolfram is currently falling but assuming £23 per unit and a value of 0.5% WO_3 in the vein the vein material is worth £11½ per ton. However it must be mined with approximately 5 tons of mullock to 1 ton of vein material to make a 2½ to 3 feet stope and this brings the value of the material extracted to just over £2 per ton.

The material must be mined by shaft since the vein is not large or extensive enough to warrant unproductive development while it remains unproven. The steep country gives facility for adit development but it is not recommended as a first step to production.

A good value was recorded from the limited sample of a six inch vein in Blacks Lode No. 8 trench. This vein possibly belongs to the same vein system as that exposed in Blacks upper shaft but it is not the same vein. The vein is worthy of investigation but the possibility of economic yield depends far more on its extent than the recording of a fair assay in a limited non-representative sample of the vein material.

The probably very limited extent of the beryl vein in No. 8 trench would make its exploitation uneconomic. The 2 inch vein gives one assay for wolfram at 1.6% in the west cuddy and none in the same vein just above. Also no wolfram is shown in the assay of vein material from the east cuddy. The distribution of beryl, wolfram and bismuth is highly irregular.

Bismuth assays high and since the samples of vein material were taken in the weathered zone within 20 feet of the surface the higher values are probably due to secondary enrichment. Bismuth concentrates are marketable at about 20/- per pound of contained bismuth and if the material from this vein could be beneficiated with respect to beryllium, wolfram and bismuth it would pay. However, it is unlikely that the values recorded

by the non-representative sampling would prove consistent nor is the limited and narrow vein likely to persist. It certainly appears to warrant no further ore dressing investigation until further extensions are opened.

The best veins examined seem to be from toward the western end of the lease. These are the veins in Blacks Lode trench No. 8, in Blacks Upper Shaft, Poveys lode and the unworked vein outcropping at the waterfall on Narrawa Creek. Few of the other veins appear to merit further attention but only a small number of the wolfram bearing veins in this part of the granite have been opened by the trenching.

BERYL

Beryl occurs in the lode at the main shaft but the best deposit exposed is the vein in No. 8 trench. This vein is part of a formation about 14 inches wide which dips 44° south striking 276°. The beryl vein on the hanging wall is about two inches wide and contains mica and wolfram as lesser constituents.

To mine one ton of beryl would then require the extraction of about 100 "vein feet" (1' x 1 veing width) of vein and up to 20 tons of mullock to open a 2½ to 3 feet stope. It should perhaps be pointed out at this stage that the vein in Sayer's No. 8 trench would not yield a total of much more than one ton.

However, from the economic point of view determination of beryl in an ore body or prediction of reserves for future use with satisfactory accuracy is impossible. This is due to the usual erratic occurrence and distribution of the mineral.

Beryl is saleable to United Kingdom at £A15 per unit (July 10th, 1952) of BeO in bags f.o.b. Australian ports with a minimum content of 9.5% BeO. Beryl theoretically contains 14% BeO. A ton of beryl concentrates then would return about £150 to offset the cost of mining about 20 tons of material, the cost of ore dressing, and marketing. There is little difference in specific gravity between beryl and the country rock and the extraction of a good concentrate is difficult.

Beryl crystals are usually hand-cobbed but the consistent advance in the price brings nearer the economic possibility of obtaining mill produced concentrates. Investigation work in the United States has apparently been successful on a laboratory scale and the operation of a mill to separate pegmatitic minerals is expected to be developed in that country shortly. However, a mill to separate beryl would not be warranted at Sayer's.

CONCLUSIONS

Several veins may be worthy of some further attention but geophysical work and ore treatment testing are definitely not warranted at this stage. It is doubtful if a seismic geophysical method could be employed to elucidate the mineralised fracture system in the granite and certainly none of the other usual geophysical methods would apply.

It is expected that future wolfram production if any, will be restricted to localised vein deposits where the width and wolfram content are greatest. Indications are that the vein in Blacks upper shaft and in Blacks lode trench No. 8 could be economic. If work on these veins is undertaken it is suggested that parcels be mined out and quartered down for assay to give better indications of the grade and that ore winning developmental work be undertaken to test the extent of the vein.

Similar remarks also apply to the Beryl Trench but the wolfram seems erratic. Beryl is usually obtained as a by-product in the mining of felspars and mica and unless further veins containing more beryl than those already opened are found the production of this mineral from Sayer's Block cannot be economical other than as a by-product to wolfram mining.

Although there are many veins they are insufficient and the wolfram content is too low to consider developing any large scale open cut project.

Sgd. (John Elliston)
REGIONAL GEOLOGIST

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7th January, 1953.